consin; nor that the Talbot represents about the same period of time. Both of these formations are singularly destitute of vertebrate fossils. On the other hand, the lowest terrace in Florida, Georgia, and the Carolinas is filled with remains of extinct vertebrates down to salt water. At Wilmington, N. C., the great sloth *Megatherium* and horses are found. The latter occur all along the coast of North Carolina, along the Potomac, and on the west shore of Chesapeake bay. The line of horse-bearing localities is then taken up at Swedesboro, N. J., is continued past Philadelphia, and ends at the Navesink Hills. From the Potomac to Raritan bay it keeps far away from the Atlantic coast. In the Fish House clays, opposite Philadelphia, considerable horse remains have been found. By the New Jersey geologist these clays are regarded as belonging to the Pensauken formation; and this is referred to the early Pleistocene. The vertebrate fossils appear, therefore, to connect the lowest terrace of the south Atlantic states with the Pensauken, rather than with the Wisconsin. Berry's admission that the Vero deposits may be as old as the Peorian shows that he does not believe that any connection with the Wisconsin drift has been established.

The writer contends likewise that the Pensacola terrace has not yet been geologically correlated in the Mississippi Valley with any definite glacial stage.

Inasmuch as Berry grants that the Pensacola terrace may be as old as the Peorian interglacial stage he and I need have no quarrel about the age of the Vero muck bed. He may perhaps yet come to acknowledge that it may be as old as the Sangamon.

As regards Dr. Chamberlin's paper it may be stated that he has decided to abandon his theory of the secondary inclusion of the vertebrate fossils—"unless all other explanations fail." He asserts (p. 667) that the dates of the appearance of man and of the disappearance of the extinct animals were among the very points brought into question and could not themselves be used as decisive criteria. With that part of this statement which concerns man I agree; but with that which regards the vertebrates I dissent. The time when those vertebrates lived and when they disappeared is to be determined by their relation to the deposits in which they have been found in a thousand or more other places in our country; and it is legitimate to apply the knowledge gained therefrom to the situation at Vero. Chamberlin seems to respect rather lightly the vertebrate fossils, for he believes that the time relations of the deposits were quite well indicated by the physical criteria, irrespective of their fossil contents. He believes, with Berry, that the marine marl bed and with it the Pensacola terrace is late Pleistocene in age. The writer takes this occasion to say that if the geologists can prove that proposition it will at once end the dispute about the time of the disappearance of the fauna represented at Vero; and vertebrate paleontology will become once more indebted to geology. Pending that proof I shall maintain, on the evidence of the vertebrate fossils, that that terrace belongs to the early third of the Pleistocene.

Dr. Chamberlin's faith in the value of fossils seems to be somewhat livelier when, in order to determine the age of the human relics at Vero, he cites the age of European pottery and men's bones; but what connection has been established between the use of pottery in Europe and its use in America?

It is not a little amusing to observe that the camels and horses and their fellows, which under the designation of a "Pliocene fauna" were used at Table Mountain to combat the existence of early man, are now, at the other, far distant, end of the line, mustered in as a "mid-Recent fauna" and called into service to continue the same war.

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SPECIAL ARTICLES

THE ANIMAL CENSUS OF TWO CITY LOTS

ASIDE from articles by McAtee, Banks and Herbert Osborn,[1] very little attention has

[1] McAtee, W. L., "Census of four square feet," SCIENCE, Vol. 26, pp. 447–49, 1907; Banks, N., "A 'census of four square feet,'" SCIENCE, Vol.

TABLE I

Animal Population of Areas of .518 Sq. Ft.

Date	Slugs	Earthworms	Millipedes	Centipedes	Sowbugs	Mites	Spiders	Thysanura	Orthoptera	Homoptera	Hemiptera	Lepidoptera	Diptera	Hymenoptera	Coleoptera	Miscellaneous	Total Insects	Total Animals	Lot
September 25		1										1	1	49	3		54	55	Green
September 26						2	3			6			3	2	2		13	18	Green
September 26		2				1	3				1	1		2	3		7	13	Green
October 2					2		6			8	1			9	4		22	30	Green
October 2					4	2	4			9		3		2	4		18	28	Green
October 5		26	3		10		2			2		1			1		14	45	John
October 5	1	19	3		12		3			7					1	2*	10	48	John
October 5		7			6		1			1				2	3		6	20	Green
October 6			1		5		2			1	1	3		2	2		9	17	Green
October 6		8			1		1			2	7		1	3	5		18	28	Green
October 11					4	1	3			6				3	9	58*	76	84	Green
October 11	2	2	1		7		8	1		8	2			4	8		23	43	Green
October 11			3							53	3			7	5		68	71	John
October 13		6										1		1	1		3	9	Green
October 25	1	3			11		1		38*		2				4		44	60	Green
October 25		2	2		1		1				1	1		1	2		5	11	John
October 25	2	2			8		12	1		2	2	1		1	4		11	35	Green
October 27		3			3		2			2		2			4		8	16	Green
October 27		8	3	1	3	1	5			10	1	9			11		31	52	John
October 31	1	1				3	2						1	1	37		39	46	John
October 31		4	1		8		1			1		10		6	1		18	32	Green
November 1		11					2				1			1	2		4	17	Green
November 1		7			2	1	5								2		2	17	John
November 3		3					3		91*	2		4			4		101	107	Green
November 3		6			8		1			44†	3			9	5		61	76	Green
November 3		1					38											39	Green
November 3		10		1	2		1			1		1		12	8		22	36	Green
November 6		17						1		1		3		1	12		18	35	Green
November 6		4										1			1		2	6	Green
November 6		4	3		1	1	5			1	1				4		6	20	John
November 9		4					2			49†	4			1	11	7	72	78	John
November 10		5			2		5							5	2		7	19	Green
November 10		5		2	23	1	9	15	12*	49†	4	1		1	16		98	138	Green
November 17							5			1		4			2		12	12	John
November 27		3		1	10		4	2		18					7		27	45	Green
November 27		1		1			1				1				5		6	9	John
November 29		3					6			2	2	4			17		25	34	Green
December 1		8			3	1	3	4		3	1	2			24		34	49	Green
December 1		3					10	1			3	2			3		9	22	John
December 6		4					4	12		17		3	4		2		38	46	Green
January 7	(Ground frozen)					1	2				2				2		4	7	Green
January 7	(Ground frozen)						2				1		4		8		13	15	John
March 22		6	2		1		5				2				4		6	20	Green
March 22			1						83*						8		91	92	John
March 30		12			21		2				2	2			3		7	42	Green
March 30		4	1		1	3			107*						2		109	118	John
April 10	1	43			1		1			158*					5	2	165	211	Green
April 10		9	4	5	15	7						1		5	9		15	55	John
April 11		19			22		2			87*	1	1	2		5		96	139	Green
April 11		10					2					3			3		6	18	John
April 12		22			5										4		4	31	Green
April 12		3	4		4	5	1		112*	4		2	1	96	1		216	233	John
April 17		13			5		1							2	6		8	27	Green
April 17		4	8	1	38	2	2	1			1	6		1	19		27	83	John

TABLE I (*continued*)

Date	Slugs	Earthworms	Millipedes	Centipedes	Sowbugs	Mites	Spiders	Thysanura	Orthoptera	Homoptera	Hemiptera	Lepidoptera	Diptera	Hymenoptera	Coleoptera	Miscellaneous	Total Insects	Total Animals	Lot
April 18		10		2	6	1	2	2		1	1			1	7		12	33	Green
April 18		21	3	3	23	4	4	3				2		6	6		17	75	John
April 23		15			5	1	1					3	2	4	1		10	32	Green
April 23		6	2		3										2		2	13	John
April 26		7			6		3	5			1			2	3		11	27	Green
April 26		11	1	3	31	2	2	1			1				8		10	60	John
May 10		11			5	1	1					1			1	3	2	23	Green
May 10		8			16	1	4	3			1	3	1	1	5		14	43	John
May 14		19	1	4	17		1	4						1	5		10	52	Green
May 14		8	2	1	42	2	5	4			2	2			3		11	71	John
May 15		7		2	8			3			1			9	2		12	32	Green
May 15		14	5	1	11		4				2	2			1		5	40	John
May 17		4	3	1	14	2	1			2		1		11			14	39	Green
May 17		2	6		2		1			1	1	3		20	1		26	37	John
May 18				1	15	1	2		3*		2	3		7	8		23	42	Green
May 18					4		3			1	1	1		42	2		47	54	John

* Indicates eggs. † Indicates partly eggs.

been given to the total animal population of definitely measured areas of land. At the suggestion, and with the aid and assistance, of Dr. V. E. Shelford, of the University of Illinois, a study was made of the animal population of two vacant lots, a block apart, in Champaign, Illinois, over a period from September, 1916, to May, 1917. The lots were on John and Green Streets, adjoining the Illinois Central Railroad. They had not been burned over for at least a year, and despite the encroachments of débris from the railroad and nearby houses, were essentially wild, being covered with grass, sweet clover, dandelions, burdocks and other weeds, while the Green Street lot had a thicket of young honey locusts on one side, and that on John Street had a brook bordered by osage orange and willows running along one side.

The apparatus used was very simple, consisting of a tin pail with the handle and bail removed, and a screw top, an inch in diameter, soldered into the bottom, through which the anesthetizing agent could be introduced. The sharp edges of the pail, where the bail had been cut away, would sink into soft earth, and with the aid of a big knife, vegetation and hard earth could be cut through, so that the animal population of that small area would be imprisoned in the inverted pail. A considerable amount of chloroform or ether was added through the screw top, and after clearing away the surrounding vegetation and débris, sufficient time would have elapsed so that all the active animals were anesthetized and the pail could be taken up without fear that any of them would escape. The vegetation within the circle was picked to pieces and shaken over newspapers, weed stems split up, the surface of the earth left bare was carefully examined and finally all the earth to a depth of six inches was dug up and sifted over newspapers, so that all animals large enough to be visible to the naked eye would be sorted out. The surface area covered by the pail was .518 sq. ft., which, multiplied by 84,092, gives the population per acre. Two examinations (one for each lot) were made daily when time was available, or the ground not too wet and sticky or frozen. The results are given in the table.

The area enclosed by the pail (.518 sq. ft.) is so small that there will necessarily be a wide

26, p. 637, 1907; Osborn, H., "Leaf-hoppers of Maine," Maine Agr. Expt. Sta. Bull., No. 238, pp. 81–160, 1915.

TABLE II

Average Animal Population for Twenty-day Periods

Period	Earthworms	Millipedes	Centipedes	Sowbugs	Mites	Spiders	Thysanura	Orthoptera	Homoptera	Hemiptera	Lepidoptera	Diptera	Hymenoptera	Coleoptera	Total Insects	Total Except Insects	Total Animals
September–October...	4.4	.8		3.6	.5	2.6			7.4	1.1	.7	.3	6.1	3.6	24	12	36
October–November...	4.7	.5		3.5	.4	5.7		10.	4.8	.8	2.2		2.	7.6	26	16	42
November.....	6.1	.4	.3	3.7	.3	3.7	2.3	1.7	14.4	1.2	1.2		1.1	7.	31	13	44
November–December..	3.7		.3	2.3	.2	4.3	3.2		6.7	1.2	1.8	.7		9.7	23	11	34
Winter:																	
March–April.....	12.8	1.2	.5	7.1	.5	1.3		30.2	24.9	.5	.9	.3	10.1	4.4	72	24	96
April.....	10.9	1.7	1.1	12.1	1.2	1.9	1.5		.1	.5	1.4	.2	2.2	6.5	12	32	44
May.....	7.3	1.7	1.	13.4	.7	2.2	1.4	.3	.4	1.	1.6	.1	9.1	2.8	16	26	43
Average.....	7.1	.9	.5	6.5	.7	3.1	1.2	6.3	8.4	.9	1.4	.2	4.4	6.9	29	19	48

TABLE III

Revised Animal Population

Period	Total Orthoptera	Orthoptera (One Egg-cluster Equals One Individual)	Total Homoptera	Homoptera (One Egg-cluster Equals One Individual)	Revised Total Animals	Revised Total Insects	Revised Total Except Insects	Animals per Acre	Insects per Acre
September–October...			7.4	7.4	33	21	12	2,665,036	1,756,932
October–November....	10	.1	4.8	3.	30	15	15	2,422,760	1,261,380
November.....	1.7	.1	14.4	3.	31	17	14	2,506,852	1,429,564
November–December .			6.7	1.5	30	18	12	2,422,760	1,513,656
Winter:									
March–April.....	30.2	.3	24.9	1.	42	1	23	3,531,864	1,597,748
April.....			.1	.1	44	2196	32	3,700,048	1,009,104
May.....	.3	.1	.4	.4	43		27	3,605,956	1,345,472

variation in abundance in all orders of animals in any two examinations, and it is only by averaging results for twenty-day periods that some idea can be gained of seasonal variation.

The great unevenness in the Orthoptera and Homoptera columns is because each individual grasshopper or mealybug egg is counted as an individual. The result is to greatly increase the apparent total animal population in the fall and early spring. But when each cluster of eggs is counted as one individual, the Orthoptera become negligible and the Homoptera decrease in numbers from early fall, the resulting total animal population showing a very striking uniformity throughout each season.

The one third increase in population in the spring over that in the autumn is due, not to insects, but almost entirely to earthworms and sowbugs—the earthworms being most abundant early in the spring when the ground is moist, and going deeper than six inches as it later dries out, but the sowbugs become most abundant in May. Variations in the Hymenoptera column are due to occasional accidental selection for examination of a plot containing a nest, or near a nest of ants, but variations in the numbers of beetles, of which many species in greatly varying abundance were found, can not be assigned to any one cause. Considerable numbers of empty puparia were found, quite out of proportion to the small number of live Diptera. Thysanura were very abundant when weather conditions were just right, but Lepidoptera (mostly cutworms) and Hemiptera showed quite uniform abundance. The data as a whole show the preponderating abundance of earthworms, sowbugs, beetles, spiders and ants in this particular habitat.

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